UCRL-JC-124949 Abs
Abstract for the Laser-Plasma Astrophysics evening symposium at
the38th Annual Meeting of the APS Division of Plasma Physics
11-15 November 1996, Denver, CO

Hydrodynamics 'experiments' on supernovae and on Nova - the laser,*

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To make progress in understanding the complex phenomena of supernovae (SN), one unfortunately does not have the luxury of setting up clean, well controlled experiments in the universe to test the physics of our models and theories. Consequently, creating a surrogate environment to serve as an experimental astrophysics testbed would be highly beneficial. The existence of highly sophisticated, modern research lasers in the 1-50 kJ class, developed largely as a result of the world-wide effort in inertial confinement fusion (ICF), opens a new potential for creating just such an experimental testbed utilizing well-controlled, well-diagnosed laser plasmas. The next generation MJ-class "superlasers" planned for the U.S. and France offer incentive to invest effort now on gaining experience using current laser facilities to develop genuinely useful laser-plasma astrophysics experiments. To draw attention to the possibilities and potentials of this emerging field, I will discuss two areas of physics critical to an understanding of supernovae that are amenable to supporting research on large lasers: (1) nonlinear hydrodynamic instability evolution in 2D and 3D and (2) the radiative shock hydrodynamics of colliding plasmas such as SN ejecta-circumstellar matter interactions. The astrophysical relevance of these areas to supernovae will be developed in a companion talk.[2]

*Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under contract number W-7405-ENG-48.

[1]In collaboration with S.G. Glendinning, J. Kane, J. Castor, A. Rubenchik, J. Colvin, R.P. Drake, R. London, E. Liang, and R. McCray.

[2]Roger Chevalier, "The radiative hydrodynamics of supernova shock waves", these proceedings.

Category:	4.6, "Hydrodynamic instability"
E.vs T:	Experiment
Type:	Oral
APS mem. #	RE694314